

SIGNIFICANT NATURAL HERITAGE RESOURCES  
OF THE ROCKY FLATS ENVIRONMENTAL TECHNOLOGY SITE  
AND THEIR CONSERVATION:

PHASE I:  
THE ROCK CREEK DRAINAGE

FINAL REPORT

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## EXECUTIVE SUMMARY

In 1993, The Colorado Natural Heritage Program (CNHP) was contracted by the Department of Energy to assess the ecological values of the Rock Creek drainage at the Rocky Flats Environmental Technology Site (RFETS). The goal of the project was to accumulate and examine existing biological data from the site, incorporate appropriate portions into the CNHP's Biological Conservation Database, and with appropriate field verification, identify significant natural heritage resources. We were also asked to make recommendations on actions that would be necessary to protect these resources.

The Natural Heritage Inventory was conducted in four steps:

1. Accumulate existing information concerning significant elements of biological diversity from existing data at the Rocky Flats Environmental Technology Site.
2. Perform ground surveys to rank occurrences of elements in terms of quality, condition, viability, and defensibility, and to identify conservation boundaries for each element.
3. Assign natural heritage Biodiversity Ranks (B-ranks) to determine significance of each occurrence.
4. Assess conservation data relative to the conservation priorities of the International Network of Natural Heritage Programs and present in a final report.

The Rock Creek drainage was determined to contain significant natural heritage resources (those species or communities determined by CNHP to be rare, threatened or endangered or of high significance) and was denoted as a "natural heritage conservation site." The Natural Heritage Program developed a preliminary conservation planning boundary for the Rock Creek drainage. In developing this boundary, a number of factors were considered including: habitat for rare species, protection of water quality, buffers from potentially detrimental land uses, and the maintenance of ecological processes necessary for the perpetuation of the significant elements in the area.

The delineation of a conservation planning boundary in this report does not confer any regulatory protection on recommended areas. These boundaries are intended to be used to support wise planning and decision-making for the conservation of these significant areas. The Colorado Natural Heritage Program encourages the Department of Energy (DOE) to take actions that will protect this site, particularly since in the Heritage Program methodology it ranks as a site of

national significance. CNHP offers its assistance in working with DOE to ensure protection of these areas.

The report includes seven recommendations for the Rock Creek Site:

1. Develop an implementation plan for designation and protection of the Rock Creek Site.
2. Incorporate the information included in this report in the review of activities in or near areas identified as significant.
3. Increase public awareness of the benefits of protecting areas determined to be significant to Colorado and the Nation's natural diversity.
4. Promote cooperation among pertinent organizations in the protection of natural diversity.
5. Properly manage significant elements of natural diversity within the Rock Creek drainage of the Rocky Flats Environmental Technology Site.
6. Conduct further inventory and study to assess other natural heritage resources.
7. Continue monitoring and life history investigations of the globally imperilled Preble's meadow jumping mouse (Zapus hudsonius preblei).

## TABLE OF CONTENTS

INTRODUCTION .....	1
Overview of the Study Area .....	1
Colorado's Natural Heritage Program .....	2
What is Biological Diversity? .....	5
Relating this Report to Managing Biological Diversity at the Landscape Level .....	6
METHODS .....	7
RESULTS .....	10
Conservation Site Profile .....	10
PROTECTION OF SIGNIFICANT BIODIVERSITY AREAS .....	21
Protection Tools .....	22
REPORT RECOMMENDATIONS .....	22
LITERATURE CITED .....	26
ACKNOWLEDGEMENTS .....	29

## TABLES

Table 1. Definition of Natural Heritage state rarity ranks. ....	4
Table 2. Rare species and significant natural communities known from Jefferson and Boulder Counties which have potential to occur* at the RFETS. ....	8
Table 3. Significant elements known from the Rock Creek Drainage .....	17

## INTRODUCTION

In 1993, The Colorado Natural Heritage Program (CNHP) was contracted by the Department of Energy (DOE), Rocky Flats Field Office to assess the ecological values of the Rock Creek drainage at the Rocky Flats Environmental Technology Site (RFETS). The goal of the project was to accumulate existing data from the site and with some field verification, identify natural heritage resources and actions to protect these resources. Natural heritage resources are defined as rare, threatened, endangered, or sensitive species and significant natural communities that are monitored by the Colorado Natural Heritage Program. In short, we were to identify those sites supporting unique or exemplary natural communities, rare plants and rare animals, and other significant natural features.

Phase I, the evaluation of the Rock Creek drainage portion of the Rocky Flats Environmental Technology Site, has been completed and the results of it are presented herein. A brief overview of the natural condition of the study area is presented first. This is followed by an outline of the mission and methodology of the Colorado Natural Heritage Program. The results of the inventory are briefly discussed. Finally, the area of national biodiversity significance identified during this study is described and future actions, including protection options, are introduced.

### Overview of the Study Area

The Rocky Flats Environmental Technology Site is located in northern Jefferson County, Colorado. The entire plant site, including the buffer zone, consists of about 6550 acres. The Rock Creek drainage comprises about 1500 acres roughly located at the northwest end of the site. Elevations range from approximately 5760' to over 6160' within the drainage. Vegetation communities are characterized by grasslands, shrublands and scattered coniferous and deciduous trees and are typical of lower foothills, mesas, and western Great Plains ecosystems (Weber 1976, Mutel and Emerick 1992, Gregg 1963). The Rock Creek drainage was at one time part of a livestock ranch. Extant fauna is dominated by a Great Plains component and enhanced by a foothills element due to the proximity of these two biogeographical units. Animal communities are generally characterized by species of the Great Plains (Mutel and Emerick 1992, Armstrong 1972, Andrews and Righter 1992, Hammerson, 1982).

The relatively recent and extensive use of the area in and around the area now occupied by the Rocky Flats Environmental Technology Site has greatly impacted the flora and fauna. Extirpations have been largely restricted to large mammals. Grizzly bears and gray wolves once roamed throughout the state and

black-footed ferret were not uncommon in large prairie dog towns (Armstrong 1972). All are no longer resident within the state. Although extinctions of bird species are not recorded, the plains sharp-tailed grouse has been extirpated from the vicinity (Braun et al. 1992). Fortunately, most species have not suffered so extensively, but many have been reduced in numbers -- some significantly. Many plant species not native to this area have become established and in some cases dominant, especially in areas that historically or currently are to some degree disturbed by human activity (including livestock grazing, alteration of natural processes such as fire or flooding, gravel mining, agricultural activity, road building or other development). It is within the purpose of this effort to identify the conservation sites which will protect the most sensitive element of natural diversity.

Climate. The climate of the area is strongly influenced by the mountains and is continental in character. Sudden and extreme changes in atmospheric conditions may occur from hour to hour and day to day at any season of the year. The average wind velocity is moderate, although strong gusts (occasionally over 80 mph) are not infrequent (U. S. Dept. of Energy 1980). Winters are generally cool and dry and summers warm. The mean first date of frost is October 4 and the mean last day of frost is May 9. Average yearly precipitation for the period from 1953-1976 is approximately 15 inches (U. S. Dept. of Energy 1992). Approximately 70% of the moisture falls during the growing season, mostly in late spring and early summer (U. S. Dept. of Energy 1992, U. S. Dept. of Agriculture 1980).

Soils. Soils are of two major types. Soils on terraces or piedmonts are a stony or skeletal type developed on glacial outwash (Rocky Flats Alluvium). Fine textured soils developed from shales and mudstones are common in the small drainages associated with Rock Creek (U. S. Dept. of Agriculture 1980).

Geology. Geology is discussed in detail in several papers or reports from the area (U. S. Dept. of Energy 1992, Branson et al. 1965, Vestal 1919) and is an important factor influencing the distribution of plant communities.

## Colorado's Natural Heritage Program

To place this report in context it is useful to understand the history and functions of the Colorado Natural Heritage Program (CNHP). CNHP has been extant in Colorado for 16 years. CNHP was relocated from the Division of Parks and Outdoor Recreation into the University of Colorado Museum in the spring of 1992, and more recently to the College of Natural Resources at Colorado State University. With an increased staff, the Program is revitalized and updating comprehensive information on the rare, threatened, and endangered species and significant natural communities in Colorado. The multi-disciplinary team of scientists and information managers gather information and incorporate it into

continually updated databases. CNHP is part of an international network of conservation data centers that use the Biological and Conservation Databases (developed by The Nature Conservancy). In addition, CNHP has effective relationships with the Colorado Natural Areas Program, Colorado Department of Natural Resources, the Colorado Division of Wildlife, and the numerous federal agencies. Concentrating on site-specific data for each element of natural diversity, the accurate status of each element becomes known. The data presented here illustrate a site that is important to the conservation of Colorado's, and indeed the nation's natural biological diversity. By using the element ranks and the quality of each occurrence, priorities can be established for the protection of the most sensitive or imperilled sites. It is by having an updated locational database and priority-setting system that CNHP can provide its most effective, proactive land-planning tools.

Information is gathered by CNHP on species, natural communities, and ecosystems. Each of these significant natural features (species and community types) is an **element of natural diversity**, or simply an **element**. Each element is assigned a rank that indicates its relative rarity on a five-point scale (1 = extremely rare/imperilled; 5 = abundant/secure; Table 1).

The primary criterion for ranking elements is the number of occurrences, i.e. the number of known distinct localities or populations. Also of great importance is the number of individuals at each locality or, for highly mobile organisms, the total number of individuals. Other considerations include the condition of the occurrences, the number of protected occurrences, population trends, and threats. However, the emphasis remains on the number of occurrences, such that ranks are an index of known biological rarity. These ranks are assigned both in terms of the element's rarity within Colorado (its State or S-rank) and the element's rarity over its entire range (its Global or G-rank). Taken together, these two ranks give an instant picture of the rarity of the element. Although most species protected under state or federal endangered species laws are extremely rare, not all rare species are listed as Endangered or Threatened and Natural Heritage rarity ranks should not be interpreted as legal designations.

Table 1. Definition of Natural Heritage state rarity ranks. Global rarity ranks are similar, but refer to a species' rarity throughout its range. State and Global ranks are denoted, respectively, with an "S" or a "G" followed by a character. Note that GA and G#N are not used and GX means extinct. These ranks should not be interpreted as legal designations.

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S1	Extremely rare; usually 5 or fewer occurrences in the state; or may be a few remaining individuals; often especially vulnerable to extirpation.
S2	Very rare; usually between 5 and 20 occurrences; or with many individuals in fewer occurrences; often susceptible to becoming endangered.
S3	Rare to uncommon; usually between 20 and 100 occurrences; may have fewer occurrences, but with a large number of individuals in some populations; may be susceptible to large-scale disturbances.
S4	Common; usually > 100 occurrences, but may be fewer with many large populations; may be restricted to only a portion of the state; usually not susceptible to immediate threats.
S5	Very common; demonstrably secure under present conditions.
SA	Accidental in the state.
SH	Historically known from the state, but not verified for an extended period, usually > 15 years; this rank is used primarily when inventory has been attempted recently.
S#B	Same rank as the numbered S-series, but refers to the breeding season rarity of migrants.
S#N	Same rank as the numbered S-series, but refers to the non-breeding season rarity of migrants; where no consistent location can be discerned for migrants or non-breeding populations, a rank of SZN is used.
SU	Status uncertain, often because of low search effort or cryptic nature of the element.
SX	Apparently extirpated from the state.

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The spot on the landscape that supports a particular population of a specific species or a specific stand of a given community type is an **element occurrence**. The Colorado Natural Heritage Program has mapped over 4,000 element occurrences in Colorado. Information on the location and quality of these element occurrences is also entered into the computerized Biological and Conservation Databases (BCD). This computer system, developed by The Nature Conservancy, is utilized by the international network of heritage programs and conservation data centers. All centers utilize the same methodology, allowing a unique, direct comparison of information throughout the area covered.

In addition to ranking each element in terms of rarity, Natural Heritage staff scientists rank each element occurrence so that protection efforts can be aimed not only at the rarest elements, but at the best examples of each. Element occurrences are ranked in terms of the **quality** (size, vigor, etc.) of the population or community, the **condition** or naturalness of the habitat, the long-term **viability** of the population or community, and the **defensibility** (ease or difficulty of protecting) of the occurrence. Given the intimate relationship between a natural community and its environment, community occurrences are largely ranked in terms of their quality and condition.

One of the strongest ways that the Colorado Natural Heritage Program uses these element and element occurrence ranks is to assess the overall significance of a site, which may include one or many element occurrences. Based on these ranks, each site is assigned a **biodiversity (or B-) rank**:

- B1 Outstanding Significance: only site known for an element or an excellent occurrence of a G1 species.
- B2 Very High Significance: one of the best examples of a community type, good occurrence of a G1 species, or excellent occurrence of a G2 or G3 species.
- B3 High Significance: excellent example of any community type, good occurrence of a G3 species, or a large concentration of good occurrences of state rare species.
- B4 Moderate Significance: good example of a community type, excellent or good occurrence of state-rare species.
- B5 General Biodiversity Significance: good or marginal occurrence of a community type, S1, or S2 species.

## What is Biological Diversity?

Biological diversity has recently become an important management issue for many natural resource professionals. Biological diversity at its most basic level

includes the full range of species on Earth, from species such as bacteria, viruses, and protists, through multicellular kingdoms of plants, animals and fungi. At finer levels of organization, biological diversity includes the genetic variation within species, both among geographically separated populations and among individuals within single populations. On a wider scale, biological diversity includes variations in the biological communities in which species live, the ecosystems in which communities exist, and the interactions among these levels. All levels are necessary for the continued survival of species and natural communities, and all are important for the well-being of humans (Temple 1991).

The biological diversity of an area can be described at four levels:

1. Genetic Diversity -- the genetic variation within a population and among populations of a plant or animal species. The genetic makeup of a species is variable between populations of a species within its geographic range. Loss of a population results in a loss of genetic diversity for that species and a reduction of total biological diversity for the region.
2. Species Diversity -- the total number and abundance of plant and animal species in an area.
3. Community Diversity -- the variety of natural communities or ecosystems within that area. These communities may be diagnostic or even endemic to an area. It is within these ecosystems that all life dwells.
4. Landscape Diversity -- the type, condition, pattern, and connectedness of natural communities or ecosystems within a landscape. Fragmentation of forested landscapes, loss of connections and migratory corridors, and loss of natural communities all result in a loss of biological diversity for a region. Humans and the results of their activities are integral parts of most landscapes.

The Rock Creek Site (Site) presented in this report supports important components of the total biological diversity of Site, the region, the State, and the Nation. This site, if protected, will represent protection for genetic, species, community, and landscape diversity.

## **Relating this Report to Managing Biological Diversity at the Landscape Level**

The management of Biological Diversity must consider more than species specific management criteria and consider the elements of human-use in the area. The conservation sites typically identified in this type of study may be considered

as core areas for the protection of the full range of biological diversity. Some of these areas are best considered as candidates for special area designations, others as sites within a landscape that should be managed to include the maintenance of the site's integrity.

A basic premise in the landscape management approach starts with the delineation of core protected areas that can be represented by special designations. Where possible, these should be connected through corridors and appropriately buffered. Buffer areas should include the ecological processes supporting the diversity of the core area. Such is the basis of the development of preliminary conservation planning boundaries.

## METHODS

The Natural Heritage staff conducted a natural heritage inventory in four stages:

1. Gather existing information. Information was accumulated from a variety of sources at the Rocky Flats Environmental Technology Site and through previously published and unpublished information. This included the gathering of maps, reviewing the BCD and manual Natural Heritage data (see table 2), and consulting experts including Rocky Flats personnel. The high quality research results of EG&G and their subcontractors were critical to being able to accurately assess the conservation priorities of the area.
2. Perform field verification and determine preliminary conservation boundaries. Ground surveys were conducted to rank occurrences of elements in terms of quality, condition, viability, and defensibility to put into perspective the state and range wide significance of the element. Preliminary conservation boundaries were identified for each natural heritage resource.
3. Assign Biodiversity Ranks (B-ranks). The site is assigned a B-rank based on the rarity, occurrence rank, and management and protection urgency of each element as it relates to the protection of biological diversity.
4. Compile the results and prepare a final report. As work was completed, Natural Heritage staff scientists reviewed the information gathered. Based on a review of all natural heritage resources present, the staff prioritized the elements in terms of their significance and the threats facing them, developed and mapped preliminary conservation planning boundaries, and crafted protection and management recommendations.

Table 2. Rare species and significant natural communities known from Jefferson and Boulder Counties which have potential to occur\* at the RFETS.

SCIENTIFIC NAME	COMMON NAME	GLOBAL RANK	STATE RANK	FEDERAL <sup>1</sup> STATUS	STATE <sup>2</sup> STATUS
<b>Birds</b>					
CHARADRIUS MONTANUS	MOUNTAIN PLOVER	G3	S2B, S2N	C2	SC
FALCO PEREGRINUS ANATUM	AMERICAN PEREGRINE FALCON	G3	S2B, S2N	LT	T
HALIAEETUS LEUCOCEPHALUS	BALD EAGLE	G4	S1B, S3N	LT	T
BUTEO REGALIS	FERRUGINOUS HAWK	G4	S3B, S5N		
NYCTANASSA VIOLACEA	YELLOW-CROWNED NIGHT-HERON	G5	S1B, S2N		
CATOPTROPHORUS SEMIPALMATUS	WILLET	G5	S1B, S2N		
SAYORNIS PHEOBE	EASTERN PHEOBE	G5	S1B, S2N		
COCCYZUS ERYTHROPHthalmus	BLACK-BILLED CUCKOO	G5	S2B		
NUMENIUS AMERICANUS	LONG-BILLED CURLEW	G5	S2B, S2N	C2	SC
SIALIA SIALIS	EASTERN BLUEBIRD	G5	S2		
LANIUS LUDOVICIANUS	LOGGERHEAD SHRIKE	G4	S3B, S2N	C2	SC
IXOBRYCHUS EXILIS	LEAST BITTERN	G5	S3B, S2N		
BUTORIDES STRIATUS	GREEN-BACKED HERON	G5	S3B, S2N		
NYCTICORAX NYCTICORAX	BLACK-CROWNED NIGHT-HERON	G5	S3B, S2N		
COCCYZUS AMERICANUS AMERICANUS	EASTERN YELLOW-BILLED CUCKOO	G5TU	S3B		
BOMBYCILLA CEDRORUM	CEDAR WAXWING	G5	S3B, S5N		
DOLICHONYX ORYZIVORUS	BOBOLINK	G5	S3B, S2N		
<b>Fish</b>					
FUNDULUS SCIADICUS	PLAINS TOPMINNOW	G4	S2	C2	
NOTURUS FLAVUS	STONECAT	G5	S1		SC
NOTROPIS CORNUTUS	COMMON SHINER	G5	S2		SC
<b>Mammals</b>					
ZAPUS HUDSONIUS PREBLEI	PREBLE'S MEADOW JUMPING MOUSE	G5T1?	S1?	C2	SC
VULPES VELOX VELOX	SWIFT FOX	G4T4	S3?	C2	U
MYOTIS CALIFORNICUS	CALIFORNIA MYOTIS	G5	S2		
SOREX MERRIAMI	MERRIAM'S SHREW	G5	S3		
<b>Reptiles</b>					
TROPIDOCOLONIA LINEATUM	LINED SNAKE	G5	S3		U
<b>Insects</b>					
SPEYERIA IDALIA	REGAL FRITILLARY	G3	S1	C2	
HESPERIA OTTOE	OTTOE SKIPPER	G3?	S2		
CELASTRINA NEGLECTAMAJOR	APPALACHIAN BLUE	G4	S1?		
ATRYTONE AROGOS	AROGOS SKIPPER	G4	S2		
ERYNNIS MARTIALIS	MOTTLED DUSKY WING	G4	S2S3		
INCISALIA MOSSI	MOSS'S ELFIN	G4	S3		
DOA AMPLA	A MOTI	G?	S1		
GRAMMIA SP. 1	A MOTI	G?	S?		
AESHNA EREMITA	LAKE DARNER	G5	S1?		
AESHNA VERTICALIS	GREEN-STRIPED DARNER	G5	S?		
CORDULIA SHURTLIFFI	AMERICAN EMERALD	G5	S1?		
CALOPTYRYX AEQUABILIS	RIVER JEWELWING	G5	SH		
ARGIA SEDULA	BLUE-RINGED DANCER	G5	S2		
ARCHILESTES GRANDIS	GREAT SPREADWING	G5	S3		
<b>Mollusks</b>					
PROMENETUS EXACUOUS	SHARP SPRITE	G?	S2		
PROMENETUS UMBILICATELLUS	UMBILICATE SPRITE	G?	S3		

## Vascular plants

SPIRANTHES DILUVIALIS	UTE LADIES' TRESSES	G2	S1	LT	1
GAURA NEOMEXICANA SSP	COLORADO BUTTERFLY WEED	G5T1	S1	C1	1
COLORADENSIS					
MALAXIS BRACHYPODA	WHITE ADDER'S-MOUTH	G4	S1	C2	2
CAREX TORREYI	TORREY SEDGE	G4	S7		3
RIBES AMERICANUM	AMERICAN CURRANT	G5	S1		2
CRATAEGUS CHRYSOCARPA	YELLOW HAWTHORN	G57	S1S2		2
VIOLA PEDATIFIDA	PRAIRIE VIOLET	G5	S2		3
EUSTOMA RUSSELLIANUM	SHOWY PRAIRIE GENTIAN	G5	S3	C2	2
RODALA RAMOSIOR	TOOTH CUP	G5	S7		3
ARISTIDA BASIRAMEA	FORK TIP THREE-AWN	G5	S7		3

## Natural communities

STIPA COMATA - EAST	GREAT PLAINS MIXED GRASS PRAIRIES	G2	S2
ANDROPOGON	XERIC TALLGRASS PRAIRIES	G2	S2
GERARDII-SCHIZACHYRIUM			
SCOPARIUM			
ANDROPOGON	WET PRAIRIES	G3	S1
GERARDII-SORGHASTRUM/NUTANS			
CAREX NEBRASCENSIS WETLAND	GREAT PLAINS WET MEADOWS	G4	S7

## 1 Abbreviations are as follows:

C2 = Category 2 Candidate

LE = Listed Endangered

## 2 Abbreviations are as follows:

1 = federal threatened or endangered that are rare throughout their range

2 = plant species which are rare in Colorado but relatively common elsewhere within their range

3 = species which appear to be rare but for which conclusive information is lacking;

\* Occurrences for bird species are only those with probable or confirmed breeding status, or significant concentration areas (wintering or migrating).

## RESULTS

Significant natural heritage resources were already known from the Rocky Flats Environmental Technology Site as a result of information gained through various research programs at the site and in the surrounding area in past years. By incorporating the previously collected information and conducting additional studies, CNHP was able to develop preliminary conservation planning boundaries that are necessary to protect the suite of natural heritage resources at the site. The elements occurring in the Rock Creek area were assessed in terms of their contribution to maintaining natural biological diversity. The following site, Rock Creek, is presented to DOE as a significant conservation site for the protection of the Nation's natural biological diversity.

### Conservation Site Profile

The conservation site is described in a standard site report. The sections of this report and the contents are outlined and explained below.

**SIZE:** The approximate acreage included within the conservation planning boundary for the conservation site.

**BIODIVERSITY RANK:** The overall significance of the conservation site in terms of rarity of the natural heritage resources and the quality (health, abundance, etc.) of their occurrences. As discussed on page 5, these ranks range from B1 (Outstanding Significance) to B5 (General Biodiversity Significance).

**PROTECTION URGENCY RANK:** The time frame in which conservation protection must occur. In most cases, this rank refers to the need for a major change of protective status (e.g. agency special area designations or ownership). The ranks range from P1 (immediate urgency; within a one-year time frame) to P5 (no known urgency).

**MANAGEMENT URGENCY:** The time frame in which a change in management of the element or site must occur. Using best scientific estimates, this rank refers to the need for management in contrast to protection (e.g. increased fire frequency, decreased herbivory, weed control, etc.). The ranks range from M1 (immediate urgency, within one year) to M5 (no known urgency).

**LOCATION:** The USGS 7.5' quadrangles that include the Conservation Site. The Natural Heritage Program code for the quadrangle is noted in parentheses.

**GENERAL DESCRIPTION:** A brief narrative picture of the topography, vegetation, and current use of the conservation site. Common names are used along with the scientific names.

**NATURAL HERITAGE RESOURCE SIGNIFICANCE:** A synopsis of the rare species and significant natural communities that occur on the conservation site.

**OTHER BIODIVERSITY VALUES:** Other items of general biodiversity interest or concern.

**CURRENT STATUS:** A summary of the ownership, degree of protection currently afforded the conservation site, and threats to the site or natural heritage resources as determined to date.

**BOUNDARY JUSTIFICATION:** The preliminary conservation planning boundary delineated in this report includes all known occurrences of natural heritage resources and the adjacent lands required for their protection. A discussion of the major factors that were considered is on pages 10-11.

**PROTECTION AND MANAGEMENT CONSIDERATIONS:** A summary of the major issues and factors that are known or likely to affect the protection and management of the conservation site.

## ROCK CREEK

**SIZE:** approx. 1500 acres within  
the RFETS

**BIODIVERSITY RANK:** B3  
**PROTECTION URGENCY:** P1  
**MANAGEMENT URGENCY:** M2

**LOCATION:** Louisville Quadrangle (3910582)  
T2S, R69W, Sects: 2,3,4,9,10

**GENERAL DESCRIPTION:** The Rock Creek Site occurs on the northern edge of the Rocky Flats alluvial mesa. Near the line separating Boulder and Jefferson counties, the site is approximately 2-3 miles east of the foothills and on the far western edge of the Great Plains. The flora is the typical natural flora of the surrounding mesas and grasslands. Most of the site was part of a livestock ranch (The Lindsay Ranch) before the property was purchased by DOE in 1974. The fauna is greatly changed from prehistoric periods with the losses or reduced populations of most of the large herbivores (e.g. bison, bighorn sheep, pronghorn and elk) and losses of the major carnivores (wolves) and omnivores (grizzly and black bears).

The Rock Creek Site is bounded on the north by State Road 128, on the west by State Road 93 and on the south and east by other portions of the Rocky Flats Environmental Technology Site. Numerous roads, diversion ditches, and gravel mines are found within or adjacent to the site. Boulder City Open Space adjoins the site to the north of State Road 128.

**NATURAL HERITAGE RESOURCE SIGNIFICANCE:** When the first pioneers came to the region, grasslands extended eastward from the base of the mountains for hundreds of miles (Mutel and Emerick 1984). Herds of pronghorn and bison were hunted by gray wolves and Indians. Today much of the natural vegetation has been replaced by croplands, cattle pastures, and human developments. Along the Front Range, extensive urbanization has dramatically changed the character of the grasslands. Due to the great loss of grasslands throughout the United States we feel special effort should be made to maintain any remaining significant grasslands. The Rock Creek area was found to have remnants of good quality grasslands. However, signs of disturbance and potential threats abound and the integrity of the area is considered highly threatened.

The Rock Creek Site contains a good example of a xeric tallgrass prairie community with a rich grass flora, a Great Plains riparian ecosystem supporting a population (or subpopulation) of Preble's meadow jumping mouse and several unusual plant communities associated with seeps.

The dominant species on the xeric grassland (xeric tallgrass prairie - Andropogon gerardii-Schizachyrium scoparium [Andropogon scoparius], Bourgeron and Engelking 1994) are big and little bluestem (Andropogon gerardii and A. scoparius), but other



common graminoids include a sedge (Carex eleocharis), Canada bluegrass (Poa compressa), and mountain muhly (Muhlenbergia montana) (U. S. Dept. of Energy 1994a). This plant association is ranked G2/S2 by the Natural Heritage Program network. The rank G2 indicates that good examples of this community are very rare, occurring in fewer than about 20 places worldwide. In Colorado, we rank this plant association as S2, reflecting its very rare nature. We believe this community to be imperilled in Colorado and rare globally. Xeric tallgrass prairies have become extremely rare, due to building, mining, and grazing (Howe 1994). These types of grasslands once occupied expansive areas on the Great Plains but have been reduced to tiny remnants. The Rock Creek xeric tallgrass prairie occupies a large area and is in good condition in places. Exotic plant species are common in patches throughout the community especially along roads or areas of disturbance. We recommend that it be included in a conservation site due to its size, fairly good condition and rarity.

The xeric tallgrass prairie ecosystem is now fractured into remnants. The placement of several to many remnants such that genetic exchange of the associated organisms is facilitated can aid in the long term persistence of the community. This may happen even though all of the individual components are insufficient. In this light, the setting aside of the Rocky Flats Site would fill a major gap between the City of Boulder Open Space prairies (the nearest at the junction of Hwy 128 and 93) and the smaller patches near White Ranch in Jefferson County. The next closest patches are in the vicinity of Ken Caryl Ranch in southern Jefferson County. The true significance of this site is best viewed from the perspective of the remaining patches of this and associated grasslands in Jefferson County and southern Boulder County. Portions of this landscape are reported in Pague et al. (1993). Associated occurrences of the grassland communities are known from the adjacent areas. It should be considered that these fragments are by themselves insufficient conservation units; however, perhaps with restored linkages, we believe that they could provide community persistence.

The Great Plains riparian community is characterized by a diverse mixture of trees, shrubs, graminoids, and forbs. Common species include plains cottonwood (Populus deltoides), coyote willow (Salix exigua), leadplant (Amorpha fruticosa), baltic rush (Juncus balticus), and various sedges (Carex species) and grasses.

The vegetation along Rock Creek is dominated by a mosaic of several plant associations: Two of which are the Populus deltoides-Salix amygdaloides/S. exigua (Plains cottonwood riparian woodland) and the Amorpha fruticosa shrubland. The first is considered of global significance by the Natural Heritage Network, G2G3/S2S3 (Globally very rare to rare and the same status in Colorado). This plant association is range-restricted and heavily impacted. The occurrence in the Rock Creek drainage is impacted, but potentially restorable. The Amorpha fruticosa shrubland is ranked GU/SU by the Natural Heritage Network, indicating its poorly known status. The GU/SU rank indicates that ranking has not been attempted for this plant association and more information is needed to document its status. Taking a conservative

approach, we will assume (because of the scarcity of information) that it is somewhat rare. This will allow us to prioritize information collection regarding this community. We suspect that this, as with other foothills and western Great Plains communities, is highly impacted throughout its range.

Vegetation communities associated with seeps are in some cases similar to other wetlands at the site supporting sedges, rushes, and cattails (U. S. Army Corps of Engineers 1994), and in some cases very different, supporting an unusual mixture of shrubs including hawthorn (Crataegus erythropoda), chokecherry (Prunus virginiana), and snowberry (Symphoricarpos occidentalis). This shrub community is unusual and may be restricted to the local area.

A unique shrubland community associated with the seeps at the Site is tentatively classified as Crataegus erythropoda-Prunus virginiana-Prunus americana seep shrubland. This plant association is ranked GU/SU by the Natural Heritage Network indicating its poorly known status. This plant association is similar to one described in Montana but Crataegus erythropoda is the dominant species in the Colorado community and Crataegus succulenta is the dominant species in the Montana community (Hansen et al. 1991). These small patches of shrublands are scattered throughout the Rock Creek drainage where seeps form at the contact of the relatively permeable Rocky Flats Alluvium and the less permeable Arapahoe Formation. This community is not well documented in the literature. Special effort should be undertaken to protect and to better understand the biodiversity significance of this community.

Other portions of the Rock Creek Site are occupied by the shortgrass prairie plant association, Agropyron smithii-Bouteloua gracilis (U. S. Department of Energy 1994a). This plant association is believed to remain common, but is also highly impacted throughout its range. The season of study for CNHP was not appropriate to assess the ecological status of this plant association. Follow-up work will occur in the field season of 1995.

The Preble's meadow jumping mouse (Zapus hudsonius preblei) occurs only in Colorado and Wyoming. The mouse is known from Colorado on the basis of fewer than 50 specimens from Larimer, Weld, Boulder, Jefferson, Denver, Adams, and Arapahoe counties (Armstrong 1972). Judging from its limited ecological and geographic distribution in Colorado, the mouse probably is a Pleistocene relict, perhaps once widespread in a tallgrass prairie across the eastern plains, but now restricted to scattered localities on the Colorado Piedmont (Fitzgerald et al. in press).

Preble's meadow jumping mouse may be one of North America's rarest mammals. This subspecies is isolated from its nearest relatives and was naturally rare (relatively) due to its restricted habitat. The Preble's meadow jumping mouse habitat appears to be restricted to relatively short distances from the riparian vegetation (Fred Harrington - personal communication; C. A. Pague - personal observation).

The status of extant populations of Preble's meadow jumping mouse is poorly known in Colorado, and unknown in Wyoming. Extant populations are known from the Rocky Flats Environmental Site, the Fort St. Vrain Nuclear Generating Station, the City of Boulder Open Space (Tracy Collins parcel and the Van Vleet parcel) (Compton and Hugie 1993). An intriguing report of the species comes from near Woodburn, El Paso County, Colorado (Jones and Jones 1985), as cited in Compton and Hugie (1993). The exact location of Woodburn is unknown at this time (personal communication with David Armstrong 1994), and no recent live trapping effort has been conducted in this area (Compton and Hugie 1993).

The first Preble's meadow jumping mouse recorded at the Rocky Flats Environmental Technology Site was captured in 1991 (Ebasco Biologists 1992, U. S. Department of Energy 1994c). Intensive trapping efforts have been conducted since 1992 (U. S. Department of Energy 1994c, 1994a, personal communication with Kevin Essington 1994; EG&G 1993a, 1992). The population at RFETS has been under study for several years and is the best known population in the state (and in the world) (Fred Harrington - personal communication; David Armstrong - personal communication). The Rock Creek population (or subpopulation) is the only known site containing sufficient numbers and habitat to be considered potentially viable. For this reason, the Rock Creek Site is considered by CNHP to be of high biodiversity significance.

The Natural Heritage Network ranks this subspecies as G5T1?/S1? indicating that the species (Zapus hudsonius) is globally common. The subspecies, noted by the T1? rank, is extremely rare and imperilled globally. Finally, Preble's meadow jumping mouse is extremely rare in Colorado, indicated by the rank of S1?. The "?" after the ranks indicate a certain level of uncertainty due to insufficient surveys over the potential range. In any case, it is the consensus of experts that this subspecies, even if more widespread, will always be considered rare (David Armstrong - personal communication).

Other mammals known from the Rock Creek site are not considered rare, threatened or endangered. The rare Merriam's shrew (Sorex merriami) is known from the Woman Creek drainage, but has not been verified from the Rock Creek drainage.

Although several special concern bird species have been observed at the Rocky Flats Environmental Technology Site, most cannot be considered occurrences of conservation significance. Tracked occurrences for bird species are only those with probable or confirmed breeding status, as per Colorado Bird Atlas guidelines (Kingery 1990), or significant concentration areas (migrating or wintering). Based on existing information, birds of special concern that probably breed within the Rock Creek Site include the loggerhead shrike (Lanius ludovicianus) and the black-crowned night-heron (Nycticorax nycticorax).

Breeding status for loggerhead shrikes is considered probable, as four to six individuals have been observed at the Site throughout the year. Loggerhead shrikes have been observed in all three drainages at the Rocky Flats Environmental Technology Site in all of the major habitat types including grassland, disturbed areas, shrubland, woodland, and marshland. More specifically, they have been recorded in cottonwoods, chokecherry, xeric grassland areas, and habitats with some Ponderosa pine (Pinus ponderosa) (Department of Energy 1994b; Marcia Murdock - personal communication).

The loggerhead shrike is ranked G4/S3 by the Natural Heritage Network. This rank indicates a widespread distribution globally while at the same time, rare in Colorado. The loggerhead shrike is not uncommon in the shrubby portions of Colorado, but is known to be declining seriously in most of the species' range. The species is recognized by the U. S. Fish and Wildlife Service as a Category 2 species, meaning that evidence exists suggesting that the loggerhead shrike may qualify for listing as a threatened or endangered species.

Black-crowned night-herons have been observed frequently during the breeding season at the Lindsay agricultural pond in the Rock Creek Drainage. This rank (G5/S3B) indicates that the species is globally common, but that breeding status in the state is rare to uncommon. Probable breeding is suggested as a pair was observed throughout the breeding season in suitable nesting habitat. Adults have been observed in disturbed habitats, shrubs, marsh, and woodland habitats. Two young were seen at the Lindsay agricultural pond later in the season (Department of Energy 1994b; Marcia Murdock - personal communication).

Table 3. Significant elements known from the Rock Creek Drainage.

	Element	Common Name	Occur. Rank	Global Rank	State Rank	Federal Status	State Status
<u>Zapus hudsonius preblei</u>		Preble's meadow jumping mouse	B	G5T1?	S1?	C2	SC
<u>Lanius ludovicianus</u>		loggerhead shrike	C	G4	S3B, S2N	C2	SC
<u>Nycticorax nycticorax</u>		black-crowned night-heron	D	G5	S3B		
<u>Andropogon gerardii</u> - <u>Schizachyrium scoparium</u>		Xeric tallgrass prairie	B, C	G2	S2		
<u>Populus deltoides</u> - <u>Salix amygdaloides</u> / <u>S. exigua</u>		Plains cottonwood riparian woodland	C	G2G3	S2S3		
<u>Amorpha fruticosa</u>		Riparian shrubland	C	GU	SU		
<u>Crataegus erythropoda</u> - <u>Prunus virginiana</u> - <u>P. americana</u>		Seep shrubland	C	GU	SU		
<u>Agropyron smithii</u> - <u>Bouteloua gracilis</u>		Shortgrass prairie	?*	G5	S4		

\* Field verification necessary to determine occurrence rank.

**OTHER BIODIVERSITY VALUES:** Data provided by EG&G, Kevin Essington, David Armstrong, and personal observations by CNHP staff demonstrated that the shrubby habitats along the riparian zone of Rock Creek and on slopes (particularly on seeps) supported numerous and diverse migratory birds. The abundance of cherries, hawthorne and sumac provide food as well as high quality cover for the birds. Birds observed included neotropical migratory birds as well as species that moved shorter distances.

**CURRENT STATUS:** The Rock Creek Site occurs largely on the Rocky Flats Environmental Technology Site, but also includes some private property at the western edge. Further investigations may indicate the need to expand the site downstream onto other ownerships. **No protective status is currently provided to the site.** In addition, the Department of Energy is considering potential future uses of the site. Designations other than a conservation designation may prove to be a serious threat to the integrity of the natural heritage resources. Gravel mining operations on the private property west, including recent proposals for extensive expansion, may pose serious threats to the hydrology of the Rock Creek Site, including riparian vegetation, seep vegetation, and therefore, the Preble's meadow jumping mouse.

The xeric tallgrass prairie occurs within the buffer zone and on adjacent private land to the west on the Rocky Flats Alluvium on relatively flat pediments. Gravel mining

operations have occurred between the Rocky Flats Environmental Technology Site portion and the occurrence immediately east of highway 93 on private land. The RFETS portion of the xeric tallgrass prairie appears to have been relatively undisturbed since the Department of Energy acquired the land in 1974, except for numerous access and fire break (gravel and two track) roads which are maintained in the buffer zone. Invasion by exotic plant species, especially knapweed (Centaurea spp.), cheatgrass (Bromus tectorum) and Japanese brome (Bromus japonicus), is the greatest threat to the prairie.

A small patch of xeric tallgrass prairie in the southeast quarter of section 4 has a dense mat of lichen (Cladonia sp.) covering the soil between plants (S. Kettler - personal observation). The dense nature of the crustose soil indicates that this may be an area that has had little disturbance for some time. This seems somewhat unusual and deserves further study. This area could be a good baseline monitoring site as some lichens are known to be good indicators of air quality.

The Plains cottonwood riparian woodland plant association (Populus deltoides-Salix amygdaloides/Salix exigua) occurs in small scattered patches along the lower tributaries and the main stem of Rock Creek. The community was probably somewhat disturbed in the past by livestock grazing and other factors. One result of this disturbance is likely the introduction or spreading of exotic plant species such as Kentucky bluegrass (Poa pratensis), smooth brome (Bromus inermis), and Canada thistle (Cirsium arvense), which now dominate the understory of the community (U. S. Army Corps of Engineers 1994). Knapweed has also invaded portions of the riparian habitat but may have done so by means of natural disturbances (spring flooding).

The seep shrubland community has also been somewhat by the introduction of exotic species which are now common in the understory (S. Kettler - personal observation). This community, which is somewhat degraded by the invasion of exotic species, is not well known or described in the literature and may be rare. Additional information is needed to more accurately assess the status of this community. This community should be of special concern when considering protection of biodiversity.

In summary, immediate threats include gravel mining operations, small population size of the Preble's meadow jumping mouse, potential alternate land use, and the invasion by aggressive weeds. We consider the Rock Creek Site to be seriously imperilled.

**BOUNDARY JUSTIFICATION:** The conservation site boundaries for Rock Creek (attached map) include all examples of xeric tallgrass prairies found on DOE land and adjacent private land, the riparian areas known to support Preble's meadow jumping mouse, and the mosaic of plant communities associated with seeps at the contact of the Rocky Flats Alluvium and the Arapahoe formation. An ecological buffer area is delineated but various human activities have encroached into this area. We also note that the buffer included in this boundary is already invaded by numerous weeds. The

Colorado Natural Heritage Program is highly concerned about the small size of native prairie remnants and considers it of importance to retain (and potentially restore) the existing remnants.

**PROTECTION RECOMMENDATIONS:** The significance of the site warrants that the Department of Energy immediately designate the Rock Creek Site as a priority ecological site. The Protection Urgency Rank of P1 indicates that the Site may be threatened by forces that could result in the loss of the element(s) within one year. Such a designation should be formal and be included in any site management plans. This protective status should also be such that it continues in effect with any transfer of the pertinent lands to other ownership or management (unless other more current biological information suggests otherwise). We also recommend that this protection status include no additional road development or other means of fragmentation of the existing site. Proposals to conduct mineral excavation should incorporate these same principles. We note that the ecological integrity of much of this site is dependent on a protected hydrological regime. Finally, since this conservation site extends beyond Rocky Flats Environmental Site boundaries, CNHP recommends that the Department of Energy work in partnership with pertinent federal, state, and local agencies as well as private conservation organizations that could assist in the protection and management of the entire conservation site.

#### **MANAGEMENT RECOMMENDATIONS:**

**Preble's meadow jumping mouse management recommendations:** This site contains the largest known and best studied population of Preble's meadow jumping mouse (Fred Harrington - personal communication, U. S. Department of Energy 1994c). Captures at this site have been reported from a variety of habitat types in and adjacent to the riparian zone of Rock Creek. Long term protection will require the maintenance of these habitats in natural condition (natural ecological functions). This includes the maintenance of supportive ecological processes. Fragmentation of the area by roads, and possibly trails, should be avoided. Road closures should be considered (perhaps through re-routing). We do not consider the existing research to be other than a positive management practice. The information thus far gained from EG&G's excellent research program is the best available for the subspecies.

CNHP is greatly concerned about the extent of weedy invasion in the Rock Creek drainage. The effects of many of these species on the Preble's meadow jumping mouse are not precisely known. Ecological theory and observation of CNHP staff suggest that serious degradation of the mouse habitat quality will occur with additional expansion of weeds, particularly knapweed species. **Exotic plants that threaten to change the structure of the habitats of the Rock Creek Site should be kept in check.**

Off-site land use may pose the greatest threat to this occurrence. Habitat destruction and alteration of the surrounding land may isolate this population, decreasing its

viability. Furthermore alteration of hydrologic regimes, possibly due to factors beyond the control of DOE, may lead to associated changes in vegetation throughout the drainage, potentially degrading Preble's meadow jumping mouse habitat on the site. Any proposed activities on this site that would significantly alter the existing hydrology should be considered a serious threat to the survival of Preble's meadow jumping mouse.

**Xeric tallgrass prairie management recommendations:** The existence of this increasingly rare xeric tallgrass prairie as a natural area could be a valuable education tool while contributing to conservation. The area should be managed as a tallgrass prairie site. The greatest threat to this community on the buffer zone is invasion by exotic plant species. Further increase of exotic species may decrease the biodiversity significance of the site by altering the native floral and faunal species composition (Bock and Bock 1988, West 1993).

Several exotic species occur in the community in various quantities. These species include cheatgrass, Japanese brome, musk thistle (Carduus nutans), Kentucky bluegrass, toadflax (Linaria dalmatica), alyssum (Alyssum minus), and knapweed. Of these species, musk thistle, toadflax, alyssum, and knapweed present the greatest threat of increasing invasion of the grassland. Other species mentioned above appear to be present in small disturbed patches but do not seem to spread into undisturbed areas. Musk thistle, toadflax, and alyssum are common in areas with little recent disturbance. Knapweed is common to dense along gravel access roads throughout the area and has spread from the roads a short distance into the relatively undisturbed prairie (S. Kettler - personal observation). It is not known if this species will spread further into the prairie over the course of time. Knapweed seems to be aggressively expanding in the area around the Front Range of Colorado (CNHP unpublished data). We observed that significant sources for several weeds are on the adjacent mining sites as well as within the Rocky Flats Environmental Technology Site. To adequately protect this ecosystem will require continued partnerships with the adjacent landowners and managers, particularly to manage weeds and restore gravel mining sites and other significant areas. Aggressive management (herbicide application, manual cutting, etc.) may be necessary to control these species. Early season grazing, burning, or mowing may be effective management tools to control many of the cool season exotic plants and favor warm season dominant native plants. Ecological Monitoring Program site TR01 (U. S. Dept. of Energy 1994a) would be considered a good baseline monitoring site because of its location in a relatively pristine part of the xeric tallgrass prairie. More species-specific management techniques are not presented in this report since relevant information already exists in the Weed Control Program described in the Watershed Management Plan for Rocky Flats (U. S. Dept. of Energy 1993).

**Great Plains Riparian Woodland and Shrubland Management Recommendations:** Exotic species heavily dominate the understory in the mosaic of plant associations that make up this community and have severely degraded the community. It is suspected that



heavy dominance by exotic species can result in drastic reduction in diversity of some animal groups (Bock and Bock 1988). The most common and problematic species include Canada thistle, Kentucky bluegrass, and smooth brome. Early season grazing, burning, or mowing may be effective management tools to control these exotic plants. Biological control already implemented at the site appears to be somewhat effective in controlling Canada thistle. Total elimination of exotic species is impossible but reducing the vigor and dominance of these species may allow native species to increase.

**Seep Community Management Recommendations:** Exotic plant species are common in the understory within and surrounding the seep shrublands (S. Kettler - personal observation). The problem species are essentially the same species listed above in the Great Plains Riparian Community. Again, these species may be controlled with early season grazing, burning, or mowing.

**Shortgrass Prairie Management Recommendations:** Due to the late season of our investigations, this occurrence was not ranked or field checked. Quantitative data from site TR02 (U. S. Dept. of Energy 1994a) suggests that at least some part of this occurrence is relatively free of exotic species, suggesting that it may be of some biodiversity significance and be useful as a baseline restoration monitoring site. We intend to further evaluate this site in the 1995 field season.

A Management Urgency Rank of M2 was assigned to the Site. This indicates that new or modified management activities may be needed within the next 5 years to insure the survival of the element(s).

## PROTECTION OF SIGNIFICANT BIODIVERSITY AREAS

This site is recommended to DOE as an area in need of special protection. The ranking system used merely ranks sites for protection relative to the rarity and quality of known significant features. Therefore, the site identified herein comprises the highest priority elements, based on known information, for the conservation of the study area's natural diversity.

Once a Conservation Site has been identified, the first step in protecting the sensitive species or communities is to delineate a preliminary conservation planning boundary. In developing these boundaries, Natural Heritage Program staff considered a number of factors. These included, but were not limited to:

- the extent of current and potential habitat for natural heritage resources, considering the ecological processes necessary to maintain or improve existing conditions;
- species movement and migration corridors;

- maintenance of surface water quality within the site and the surrounding watershed;
- maintenance of the hydrologic integrity of the groundwater, e.g. by protecting recharge zones;
- land intended to buffer the site against future changes in the use of surrounding lands;
- exclusion or control of invasive exotic species; and
- land necessary for management or monitoring activities.

As the label "conservation planning" indicates, the boundaries presented here are for planning purposes. They delineate ecologically sensitive areas where land-use practices should be carefully planned and managed to ensure that they are compatible with protection goals for natural heritage resources and sensitive species. All land within the conservation planning boundary should be considered an integral part of a complex economic, social, and ecological landscape that requires wise land-use planning at all levels.

## Protection Tools

Intensive land use in Colorado and multiple demands for many areas contribute to the continual degradation of many natural communities, endangered species habitats, and other types of natural areas. Best management practices can help protect critical buffers, but may not be adequate in the protection of sensitive species and sites. The first and most significant and proactive tool for protection is the continued identification of locations of rare species, natural communities, and the ecosystems that support them. Only with this information can informed decision-making occur.

This document provides base-level information to begin a planned protection effort of the significant biodiversity features within the Rock Creek drainage at Rocky Flats Environmental Technology Site. By using careful planning, and a monitoring program, the significant elements of natural diversity identified herein will be adequately conserved.

## REPORT RECOMMENDATIONS

1. Develop an implementation plan for designation of the Rock Creek Site.

This work has documented the existence of several elements deemed to be significant for the protection of Colorado's natural diversity. These elements have been incorporated into one conservation site for the Rock Creek drainage. This site is ranked B3 by CNHP and is considered of state, regional, and national significance. Designation of the Rocky Flats Environmental Site portion of this site should occur rapidly to respond to the urgency of threats. Designation of the Rock Creek Site as a National Environmental Research Park (NERP) is warranted. We also encourage DOE to recognize the area as a Research Natural Area (RNA). The significance of ongoing research activities combined with known ecological values would be formally recognized for their national importance.

2. **Incorporate the information included in this report in the review of activities in or near areas identified as significant.**

The area identified in this study is known to support unique or exemplary natural communities and rare species. As proposed activities within the RFETS are considered, they may be compared to the map presented herein. Should any proposed project potentially impact the Rock Creek Site, DOE can decide if it is desirable to contact persons, organizations, or agencies with expertise. The Colorado Division of Wildlife, Colorado Natural Areas Program, and Colorado Natural Heritage Program routinely conduct environmental reviews statewide and should be considered available resources.

3. **Increase public awareness of the benefits of protecting areas determined to be significant to Colorado's natural diversity.**

Natural lands are becoming ever more scarce especially in near proximity to densely populated metropolitan areas. Rare species will continue to decline if not given appropriate protective measures. Increasing the public's knowledge of the remaining significant areas will build support for the programmatic initiatives necessary to protect them. Such activities could be done through interpretive facilities, conferences or meetings to stimulate public involvement, and information pamphlets. Finally, it would be desirable for DOE to promote any protective designations to the public and scientific community to build awareness of DOE's commitment to the protection of sites of national ecological significance.

4. **Promote cooperation among pertinent organizations in the protection of natural diversity.**

The long-term protection of natural diversity at the site will be facilitated with the cooperation of many organizations. Personnel at the site have played a

leadership role in attempting to incorporate diverse opinions in the planning process. Efforts to this end should continue, providing stronger ties among federal, state, and local and private interests involved in the protection or management of natural lands.

**5. Properly manage significant elements of natural diversity within the Rock Creek drainage of Rocky Flats Environmental Technology Site.**

The first step in accomplishing this recommendation would be the appropriate designation of the identified conservation site. In doing so, the development of management plans would be a necessary component of the site designation. Several organizations and agencies are available for consultation in the development of Management Plans for significant natural lands (e.g. Colorado Natural Areas Program, Jefferson County Open Space, the City of Boulder, The Nature Conservancy, and the CNHP). We would also encourage the development of partnerships that could research and develop techniques for maintaining or restoring conservation sites to aid in the preservation of rare, threatened, or endangered species or significant natural communities (e.g. Colorado Division of Wildlife, Colorado Native Plant Society, The Nature Conservancy, and various academic institutions). Because some of the most serious threats to the Rock Creek ecosystem are off-site (altered hydrology, residential encroachment, exotic species invasion), these partnerships become essential to the long term protection of the area.

**6. Conduct further inventory efforts to assess other natural heritage resources.**

The seep shrublands need to be quantitatively evaluated. The similarity to other plant communities, the range, distribution, and naturalness of this community need to be evaluated. In addition, the area of xeric tallgrass prairie covered with lichen should be documented in more detail.

Several rare plants may potentially occur in the area. Field surveys for special concern plants should be conducted in the appropriate season (especially those not already searched for during the Baseline Biological Characterization (Department of Energy 1992) and by EG&G contractors (1993b).

There are several butterflies and moths of special concern known from the region with suitable habitat at the Rocky Flats Environmental Technology Site. Preliminary butterfly and diurnal moth surveys were conducted at RFETS during the 1991 field season. Results were included in the 1992 Baseline Biological Characterization Report. Several moths and 54 butterflies were recorded, none of which are known to be rare. In 1994, 190 butterfly species are known from Boulder County, 181 butterfly species are known from Jefferson County, and 103 species are known from Denver County (Stanford 1994). Although these

numbers reflect the diverse vegetation types and topography occurring in these counties, more than 54 species can be expected from the vicinity of RFETS.

Targeted searches for rare butterflies and moths using life history information should be conducted. At least one globally rare butterfly (Hesperia ottoe, G3?/S2) is known to occur very near the Site on habitat very similar to the Xeric tallgrass communities identified above. Two state rare butterflies, Atrytone arogos and Polites origenes, use Xeric tallgrass prairie species as larval host plants.

Other invertebrates possibly occurring at the Rocky Flats Environmental Technology Site, including aquatic species, may also be significant. Many terrestrial and aquatic invertebrates were collected and analyzed for the 1992 Baseline Biological Characterization Report. However, most have not been identified to the species level. Species level information is necessary in assessing conservation priorities.

Several special concern bird species have been recorded at the Rocky Flats Environmental Technology Site, although most cannot be considered occurrences of conservation significance. Field surveys designed to evaluate breeding status of special concern species at RFETS may reveal new occurrences which will guide conservation and management decisions. Significant foraging grounds for peregrine falcons and bald eagles, and migratory concentration areas are also of interest.

Further surveys for natural heritage elements identified elsewhere on the plant site should be conducted to determine the extent and quality of these occurrences. Natural heritage element occurrences reported from the Rocky Flats Environmental Technology Site, but not known from Rock Creek, include Merriam's shrew (Sorex merriami, G5/S3) and Fork-tipped three-awn (Aristida basiramea, G5/S?).

7. Continue monitoring and life history investigation of Preble's meadow jumping mouse.

Information from the studies being conducted at Rocky Flats Environmental Technology Site will be very valuable in determining proper conservation actions to protect this species. It is critical that this information is shared with other organizations and agencies so that they may fine tune their inventory efforts.

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